

# Ultrasound-Guided Lumpectomy of Nonpalpable Breast Cancers: A Feasibility Study Looking at the Accuracy of Obtained Margins

FRANS D. RAHUSEN, MD,<sup>1</sup> ANNETTE H. M. TAETS VAN AMERONGEN, MD,<sup>2</sup>  
PAUL J. VAN DIEST, MD,<sup>3</sup> PAUL J. BORGSTEIN, MD,<sup>1</sup> ROBERT P. BLEICHRODT, MD,<sup>1</sup> AND  
SYBREN MEIJER, MD<sup>1\*</sup>

<sup>1</sup>Department of Surgical Oncology, Academic Hospital Vrije Universiteit,  
Amsterdam, The Netherlands

<sup>2</sup>Department of Radiology, Academic Hospital Vrije Universiteit,  
Amsterdam, The Netherlands

<sup>3</sup>Department of Pathology, Academic Hospital Vrije Universiteit,  
Amsterdam, The Netherlands

**Background and Objectives:** Complete excision of a nonpalpable breast cancer after wire localization is a difficult procedure. Often, adequate margins are not obtained, and a second procedure is then required. Prospectively, we studied the feasibility of ultrasound-guided excisions of nonpalpable breast cancers, with particular attention to the accuracy of the procedure in obtaining adequate margins.

**Methods:** Prospectively, 19 patients with 20 mammographically detected nonpalpable, highly suspect, breast tumors were entered in this feasibility study. In 15 of these, the diagnosis of invasive malignancy was established preoperatively. All patients underwent ultrasound-guided excision with the intent to obtain adequate margins. We also reviewed our own experience with the excision of nonpalpable breast cancers after wire localization.

**Results:** Of the 20 excisions with ultrasound guidance, there were 19 carcinomas and 1 ductal carcinoma in situ. Of the 19 carcinomas, 17 (89%) were excised with adequate margins. Of the 43 carcinomas that were excised after wire localization, only 17 (40%) had been resected with adequate margins.

**Conclusions:** Ultrasound-guided excision appears to be a reliable procedure for obtaining adequate margins in the resection of nonpalpable breast cancers. Other advantages of this procedure are increased patient comfort and decrease in operating room time.

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**KEY WORDS:** nonpalpable; mass screening; mammography; ultrasonography; breast neoplasms; segmental mastectomy; needle biopsy

## INTRODUCTION

With the introduction and widespread use of screening mammography, breast cancers are detected at an earlier stage, resulting in an overall survival benefit in the treatment of breast cancer [1,2]. Consequently, the proportion of treated breast cancers that are not palpable is steadily increasing, and of all stage I and II breast cancers, 27% have been reported to be nonpalpable [3].

There are two objectives in the management of nonpalpable, mammographically detected breast lesions. One is to establish a diagnosis. The other is to perform an adequate excision when the tumor appears to be malig-

\*Correspondence to: Sybren Meijer, MD, Professor of Surgery, Department of Surgical Oncology, Academic Hospital Vrije Universiteit, P.O. Box 7057, 1007 MB Amsterdam, The Netherlands.  
E-mail: hm.kempes@azvu.nl

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nant. It is preferable not to submit the patient to a surgical procedure for diagnostic purposes. At present, a histologic diagnosis of mammographically detected, nonpalpable breast lesions can be established percutaneously in most patients, and an excisional biopsy is often no longer required. Needle biopsies can be done either stereotactically or under ultrasound guidance. Ultrasonography of the breast is used routinely for the detection and differential diagnosis of breast lesions. Ultrasound (US)-guided needle biopsies of mammographically detected breast lesions are being performed increasingly as an alternative for stereotactic needle biopsies [4,5]. Once the diagnosis has been established, excision of a mammographically detected, nonpalpable breast cancer as part of breast conserving treatment presents a challenge to the surgeon. Excision of these malignancies after wire localization is cumbersome and often ends with disappointing results because the resection margins are frequently positive for tumor invasion [6]. Although not all mammographically detected, nonpalpable breast cancers are visualized with US, it can accurately delineate these small lesions in 50–60% of cases [7,8]. We report on our early experience with excision of nonpalpable breast cancers, using intraoperative US guidance, as an alternative technique for excision after wire localization, paying particular attention to margin clearance. We also review our experience with the excision of nonpalpable breast cancers after wire localization.

## MATERIALS AND METHODS

### Patients: US-Guided Excision

At our institution, US of the breast is done routinely in all women with mammographically detected, nonpalpable breast lesions. Nineteen consecutive patients with 20 nonpalpable, mammographically suspect breast lesions that were also visualized with US were entered into this study between December 1996 and May 1998. All patients underwent US-guided core biopsy of the lesion, and a histologic diagnosis of invasive breast cancer was established in 15 cases (75%). Of the remaining 5 suspect lesions, there was no definitive histologic diagnosis prior to surgery. The average age of the patients was 60 years (range, 37–74 years). All patients were planned for therapeutic resection (lumpectomy) under US guidance instead of excision after wire localization. Informed consent was obtained from all patients.

### Technique of US-Guided Excision

The procedure is performed under general anesthesia. Both surgeon and radiologist are scrubbed for the procedure. The US probe has a 10-MHz transducer with an “L”-shaped head measuring  $3 \times 1 \times 1$  cm and is coupled to a mobile US unit (HAD 3000™, Advanced Technology Laboratories, Bothell, WA). The US probe is covered with a sterile sheath. After sterile preparation and

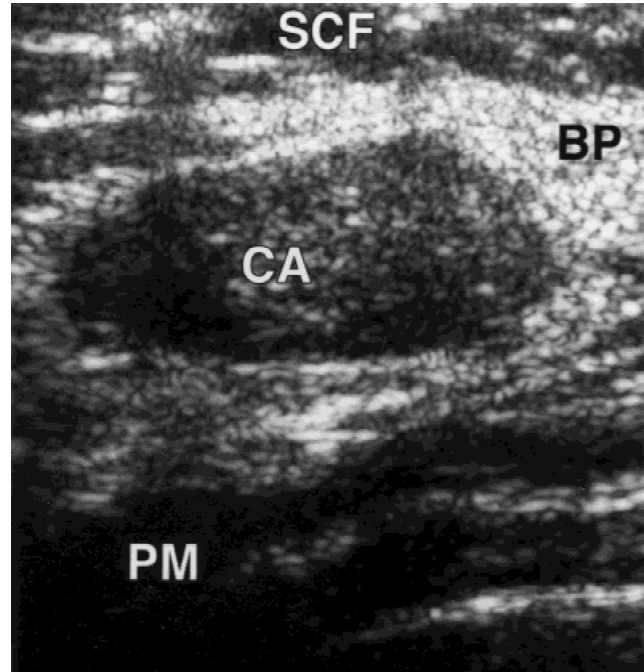


Fig. 1. Ultrasound image of a 10-mm nonpalpable breast cancer. SCF, subcutaneous fat; BP, breast parenchyma; CA, carcinoma; PM, pectoral muscle.

draping, the lesion is carefully localized in the breast by US before incision. The breast tissue is moved in such a way that the lesion comes closest to the skin surface (Fig. 1). The breast is held in that fixed position by an assistant during the entire procedure. This facilitates US localization of the lesion at all times during the procedure. The tumor size, the lesion-to-skin distance, and the lesion-to-fascia distance are measured in millimeters by US. After the incision, the skin overlying the lesion is dissected from the subcutaneous tissues, and the US probe is positioned in the wound to reassess the position of the lesion. Subsequently, a spherical lump of breast tissue is identified with the aim of obtaining a margin of about 1 cm around the lesion. To achieve this margin, the US probe is applied repeatedly in the wound from different angles while continuously monitoring the location of the tumor. After completion of the resection, the specimen is scanned ex vivo with US to assess the completeness of the excision.

### Patients: Excision After Wire Localization

We reviewed the records of all patients who underwent excision of nonpalpable breast lesions after wire localization at our institution from January 1993 to January 1998. There were 43 invasive breast cancers. A preoperative needle biopsy was done in 31 of 43 patients with carcinoma. In 21 patients, the diagnosis of carcinoma was established preoperatively (68%). Three biopsies showed atypia, 1 suggested ductal carcinoma in situ

**TABLE I. Microscopic Margins After Ultrasound (US)-Guided and Wire-Guided Excisions**

	US (n = 18)	Wire (n = 43)
Margins involved	0	17
<1 mm	1	9
1–2 mm	2	3
>2–5 mm	2	4
>5–10 mm	10	9
≥10 mm	3	1

(DCIS), and the remaining 6 were nondiagnostic. The average age of these patients was 62 years (range, 50–81 years).

### Wire Localization Procedure

All patients were taken to the radiology department on the morning of surgery. Wire placement was performed with a stereotactic biopsy unit (Mammomat 3000™, Siemens-Elema, Solna, Sweden). After lumpectomy, specimen radiographs were taken in two directions to verify the completeness of excision.

### Pathology

The resection margins of the excised lump were marked with black ink, and the tissue was cut in 5-mm-thick slices. Subsequently, the material was fixed in neutral buffered formaldehyde and processed in paraffin blocks according to standard procedure. Sections 4  $\mu$ m thick were cut and stained with hematoxylin–eosin. The microscopic margins of all specimens were determined. For both the wire localization and the US-guided excisions, a radical resection was defined as having a microscopically tumor-free margin of at least 1 mm.

## RESULTS

### US-Guided Excision

Of the 20 lesions excised, 19 were invasive carcinomas and 1 was a DCIS on postoperative histologic examination. Of the 19 invasive malignancies, 17 (89%) were radically excised, with histologic margins of at least 1 mm (Table I). Both failures were in patients in whom the diagnosis of breast cancer was established before surgery. The first failure was early in our experience with this technique (third patient), and although the margins were free, the closest margin was <1 mm. The second failure was due to a different nonpalpable (benign) lesion in the same breast being mistaken for the cancer. The actual carcinoma was histologically diagnosed with core needle biopsy by a radiologist different from the one present during surgery. That tumor was excised in a second operation. The average size of all lesions as measured with histologic examination was 1.2 cm (range, 0.4–2.6 cm).

### Excision After Wire Localization

Of the 43 nonpalpable breast cancers excised after wire localization, only 17 (40%) had been resected with an adequate margin of at least 1 mm (Table I). The knowledge of a correct histologic diagnosis prior to excision did not lead to an improved success rate in margin clearance. Tumors that had a preoperative diagnosis of invasion, DCIS, or atypia were adequately resected in 42% of cases. Without a preoperative diagnosis, resection was adequate in 39% of cases. The average size of the lesions was 1.2 cm (range, 0.4–4.0 cm).

## DISCUSSION

Techniques that are used in the management of nonpalpable breast cancers should have diagnostic accuracy, on the one hand, and must facilitate radical excision, on the other. Initially, studies with the wire localization technique focused on its diagnostic accuracy. Needle biopsies are now replacing this diagnostic intervention. From a therapeutic standpoint, however, the wire localization technique is far from reliable, and there is a concern about the re-excision rate of nonpalpable breast cancers.

US of the breast is already being used extensively for diagnostic purposes. It enables differentiation between solid and cystic lesions, and it serves as a guiding tool for aspiration of cysts and for needle biopsies of solid tumors. US can also detect breast cancers that are not found with mammography or physical examination [9].

We have extended this experience to the use of US in the surgical treatment of nonpalpable breast cancers. The main objectives were to facilitate the surgical procedure and to improve the adequacy of margin clearance, thereby avoiding the necessity for reoperation. We have succeeded in obtaining sufficient margin clearance in 89% of patients with a nonpalpable breast cancer. Although our experience with US-guided excisions is limited to only 19 patients thus far, we think the results with this technique are very promising. The most satisfying aspect of this surgical procedure is the fact that the surgeon is aware of the exact location of the lesion in relation to the overlying skin and underlying fascia at all times during the operation. This enables a radical excision of the tumor because an adequate margin of normal tissue is easily obtained. A possible disadvantage of the technique is the fact that an extra physician, the radiologist, is required for the procedure. However, the same radiologist that is scrubbed for the procedure would otherwise be required to perform the insertion of the hook-wire in the radiology department. When surgeons become more familiar with the use of intraoperative US, the radiologist may no longer be required to participate in the resection of nonpalpable breast cancers that are visualized with US.

Excision of nonpalpable breast lesions after wire localization has been the reference standard up to now. However, the results of margin clearance are disappointing, even when the diagnosis of cancer is known preoperatively. The low success rate reported in this study (40%) has been described by others [6,10]. Chinyama et al. reported on the need for re-excisions after wire localization procedures and, when looking at the results of all 264 excisions of both invasive and in situ carcinomas after wire localization, found a margin of at least 1 mm in only 53% of excisions [10].

There are several explanations for the low success rate with wire-directed excisions. To begin with, the spatial relationships among the wire tip, lesion, and surrounding breast parenchyma, as shown on the mammogram, may have changed. In the radiology department, the patient is in the upright sitting position, with the breast compressed during insertion of the hook wire. This is very different from the situation in the operating room, where the patient is supine, with no pressure applied to the breast. Furthermore, the wire may have migrated between the time of insertion and the beginning of surgery. Possibly, the main reason for an inaccurate excision is that the surgeon is supplied with two-dimensional images of the breast after insertion of the hook wire. The surgeon then has to imagine the three-dimensional situation that will enable an adequate excision of the nonpalpable lesion. This is even more difficult when the tip of the hook wire is not positioned properly in the center of the lesion.

The wire localization procedure has several other disadvantages. Insertion of the wire before surgery is very often experienced as a stressful event by the patient. Anxiety and discomfort are common; occasionally, a patient has fainted during the procedure [11]. Another disadvantage for the patient and for the hospital staff is that she is not admitted for a simple surgical procedure only. She also has to be scheduled for additional mammograms in the radiology department. After excision, the specimen needs to be brought to the radiology department for radiographic verification. This verification of the specimen can give the surgeon a false sense of security in having excised the lesion adequately. Graham et al. [12] showed that, of the 56 specimen radiographs with tumor-free surgical margins, only 18 were confirmed histologically. The radiologic definition of the tumor does not seem to correlate with the actual histologic tumor extension.

The wire localization procedure has always been sufficiently accurate for diagnostic purposes. However, this procedure does not have the required accuracy for definitive treatment of nonpalpable breast cancer. This is especially important when a diagnosis is established before surgery with increasing accuracy by both fine-needle aspiration and core-needle biopsy [13–15]. Surgical excision of these lesions for only diagnostic purposes is therefore often no longer necessary. In many

instances, a surgeon will excise a nonpalpable lesion already aware of the diagnosis and for definitive treatment. The impact of core biopsy on the surgical management of nonpalpable breast cancer has been reported by Liberman et al. [16]. A single surgical procedure was performed significantly more frequently when a preoperative diagnosis was available.

In our experience, the sentinel node procedure can be performed with the lumpectomy when the preoperative diagnosis is known [17]. In patients with nonpalpable breast cancers, peritumoral injection with radioactive colloid is done before surgery under US guidance and followed by lymphoscintigraphy. The sentinel node is excised after intradermal injection of the blue dye, as previously described [18]. The US-guided lumpectomy is performed immediately after excision of the sentinel node.

## CONCLUSIONS

The proportion of nonpalpable breast cancers is at least 20% in populations in whom screening mammography is common practice. Therefore, many women will benefit from technical improvements that enable a safe and single breast-preserving surgical procedure. US-guided excision appears to be a reliable procedure for obtaining adequate margins. Other advantages of this procedure are that patients will not have to undergo the unpleasant wire placement before surgery and that specimen radiographs after excision are not required.

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